

Public Works People pressures spur rapid sewer rehabilitation. (sewer line complex in Miami Beach, Florida)

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Mix 100,000 permanent residents and 10 million annual visitors with a wastewater collection system built mostly in the 1920s and you have people pressures that spell trouble. Add ground elevation maximums of only 6 ft above sea level - and minimums of 3 ft - plus one of the heaviest annual rainfalls in the nation - plus the possibility of seawater intrusion from all sides, and you can see why tourist-attractive Miami Beach, Florida has to maintain continual vigilance of its 170-mile gravity sewer line complex.

Said to be the most intensive sanitary sewer infiltration and inflow (I/I) analysis and mitigation program in its entire history, the city - under the supervision of public works director Vincent Akhimie, P.E. - has selected a combination of specialists to quickly identify and cost-effectively reduce the I/I problems that now exist. Kimley-Horn & Associates, (West Palm Beach, Florida), as general engineering consultants, is directing the work of RJN Group, Inc. (Boca Raton, Florida and Wheaton, Illinois), evaluation engineers, and Video Industrial Services Inc., (Birmingham, Alabama and Chicago, Illinois), cleaning and televising specialists. When completed, their four-phase program is projected to save the city about \$3 million per year in reduced treatment costs. Activities are planned so that the highest priority items are addressed first, with the costs integrated into the city's overall capital improvements schedule.

In Phase I of the program, using data and maps provided by the city, Kimley-Horn started its analysis by delineating boundaries of the areas tributary to the city's 14 major pumping stations. After compiling and evaluating existing daily flow data from each station, individual tributary areas were prioritized and a report prepared for the city that summarized the overall approach for field studies to be performed in Phases II and III. Included were analyses of existing flow data, subdivision of the entire city into 24 basins, an integrated road improvement program and schedule, suggested flow monitoring locations for each basin, and estimated costs.

Prioritization

With the Phase I report reviewed and accepted, Kimley-Horn was given the go-ahead to begin work in all 24 basins, each ranging in size from 25,000 to 150,000 linear ft of piping. Outside the pipelines, groundwater gauges were field-inspected, installed, calibrated, and maintained. Inside the pipelines, flow data were collected by flow meters and by conducting cluster-type flow isolations. Clusters found to have excessive infiltration were recommended for I/I source detection in Phase III.

This phase began last August. I/I sources are being pinpointed through manhole inspections, pipeline video inspections, dual-blower smoke tests, and dye flood tests. The analyses that follow consist of using a computer aided support system (CASS) defect model to help prioritize rehabilitation in terms of costs and related source flow. CASS prioritizes point-by-point rehabilitation of defects found by inspection and other measurements. Produced in spreadsheet format, the printouts estimate the cost and I/I reduction for each defective manhole and pipeline section in order of their magnitude, and as such give everyone concerned an accurate, easy-to-follow guideline for planning the mitigation work needed.

Because of the flat terrain, the field work has to be coordinated with pumping, which affects all studies downstream, and with pump shutoff, which affects every thing upstream. Assistance from Dan Shepherd, city supervisor of water and wastewater operations, and his staff has contributed substantially to project efficiency. Phase II isolations found to be curiously high have been explained during these Phase III field activities as resulting from major system defects or excessive flows from the thousands of people staying in the city's many resorts and hotels or patronizing its 24-hour night clubs.

At the same time, specialized subcontractor Video Industrial Services has been cleaning and televising every cluster identified as troublesome in Phase II. Its work total will eventually encompass more than 500,000 linear ft. Pipe diameters range from 6 to 48 in. Most are 8-in. clay laid before World War II, most about 5 ft deep, which, given Miami Beach's flat island location, puts them under groundwater depths most of the time.

In spite of delays caused by traffic, narrow streets, and population congestion, Video's two-man crews clean and televise an average of 1,500 to 2,000 linear ft of line per crew per day. Crews' use of new 80-gpm 2000-psi truck-mounted jetters in place of the conventional 65-gpm 2000-psi units generally utilized for cleanout is credited with increasing production on this portion of the task by 20 to 25 percent over typical projects.

Inspection of each specified pipeline segment starts with Video's crew, their jetter truck, and TV vehicle set up on the initial upstream manhole-to-manhole section. Lines are cleaned by application of high-volume, high-pressure water. Any sand, grease, rock, gravel, or other debris in the section is moved and trapped at the downstream manhole. Removal is done from this point by clamshells and other tools. The jet cleaning itself usually takes three passes and two hours for each manhole-to-manhole section.

Television inspection comes next. As a closed-circuit camera self-propels itself through the cleaned line section by means of its crawler carrier, it relays continual interior pictures back to the contractor's TV control truck for videotape recording and audio descriptions. To tape, inspect, and record observations takes 45 to 60 minutes per section.

Because the contractor's crews are self-sufficient, 100 percent inspection by the consultants, engineers, or city personnel has proved unnecessary. Deficiencies discovered so far have been typical of any sewer system - breaks in the piping, mis-aligned and deteriorated joints, and defective house connections being the most common. In two locations, the sewer pipe was reported to have completely deteriorated and cavern-like areas developed under the roadway. The city was notified immediately and the problems, previously unknown and unsuspected, were repaired without delay or incident.

Plan and specification preparations have already begun for zone repairs determined by Phase III analysis to be cost-effective. Kimley-Horn is working on Phase III and Phase IV concurrently because correcting the major I/I sources will reduce the city's treatment costs as soon as each rehabilitation step is completed.

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